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August 22, 1991

Gale Chapman
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Dear Gale,

During our meeting on burner issues in Salt Lake City on July 16, 1991, it became somewhat apparent to me that indeed Babcock & Wilcox's approach to IPSC's burner re design seemed archaic, or, as you put it, "barnyard" engineered.

On the surface this may seem to be the case. However, this correspondence serves to disclaim that notion.

Don Langley attended the RJM Corporation presentation in Los Angeles on July 31, 1991. According to both Don Langley and yourself, Mr. Monroe's presentation was indeed professional and "it sold."

It is my understanding that Mr. Monroe's presentation was centered around a technical paper titled, "Reduction of Nitrogen Oxides Emissions by Combustion Process Modification in Natural Gas and Fuel Oil Flames: Fundamentals of Low NO_x Design, M. A. Toqan, L. Berg, and J. M. Beer, Massachusetts Institute of Technology." Unbeknownst to both Don Langley and myself at the time of our Salt Lake City meeting, Babcock & Wilcox had submitted a research and development proposal to the U.S. Department of Energy for "Engineering Development of Advanced Coal-Fired Low-Emission Boiler Systems," dated April 1, 1991.

The Babcock & Wilcox team for the advanced low NO_x burner system includes, among others, J. M. Beer and the MIT combustion research facility around which RJM's Mr. Monroe centered his presentation. It must be noted that the MIT paper and information Mr. Monroe used for the basis of his presentations and conclusions was formulated with gas and oil firing, not coal, which is, as you know, an all together "different animal."

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I have reviewed that portion of the proposal to the U.S. Department of Energy concerning burner development. Four Babcock & Wilcox computer codes: COMO, FORCE, FURMO, and NOXMO will be used to handle burner and furnace flow, combustion, heat transfer and NO_x .

Burner development will be a joint Babcock & Wilcox - MIT effort, utilizing the development of mathematical models capable of computing the spatial distributions of flow, major species concentrations, and temperatures. In the modeling studies, MIT intends to use the fluid dynamic computer code Fluent, but also will rely on Babcock & Wilcox for the application of its proprietary model concerning the coal devolatilization, char burning and radiation submodels.

The major thrust of the program is to analyze via experimental studies, sensitivity analysis, and testing of both mathematical and scaled-down burner models with sufficient vigor to provide the necessary confidence in the model's capacity for its use in burner scale-up.

It appears that RJM Corporation has extrapolated pilot-scale data and mathematical modeling input on gas and oil firing, correlated it to coal firing, and scaled up to a full-scale coal burner application.

Full-scale design must be based upon pilot-scale data and modeling input (using the appropriate fuel). The attached references (1,2) of recent literature provide challenging comments regarding scaling. Richter (reference 1) states that mathematical modeling must be considered as an alternative to pilot-scale testing. At the least, modeling can be used to support the scale-up of pilot-scale data. He adds that it is almost impossible to achieve duplicate time/temperature histories between pilot- and full-scale furnaces. Lack of geometrical similarity, and differences in local flow, mixing, heat release patterns, and radiation (which can affect ignition characteristics) can limit the extent to which pilot-scale data can be extrapolated. Similar arguments are presented in the EPRI report. Johnson and Sotter (reference 2) conclude from their survey of pilot-scale test facilities that, among other things, NO_x and unburned carbon results cannot be accurately scaled up.

Gale Chapman
Intermountain Power Service Corp.

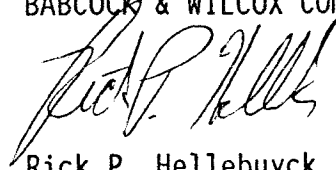
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Gale, I felt compelled to send you this correspondence to raise RJM proposed design questions, and to assure you that Babcock & Wilcox does, without question, practice sound engineering research and development, and, in this case, first hand with the Massachusetts Institute of Technology and associated personnel whom Mr. Monro referenced during his presentation.

Very truly yours,

BABCOCK & WILCOX COMPANY



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enclosures

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REFERENCES

1. Wolfgang Richter, "Scale-Up and Advanced Performance of Boiler Combustion Chambers," paper 85-WA/HT-80, presented at the winter annual meeting ASME, Miami Beach, FL, Nov. 17-21, 1985.
2. T. R. Johnson and J. G. Sotter, Application of Pilot-Scale Coal Testing to Utility Boilers, Final Report, EPRI No. CS-5946, July, 1988.